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**Dr. Blaxall's Report to the Local Government Board upon
an Outbreak of Diphtheria at Berkhamstead, Herts,
and upon the Sewerage of the Town.**

GEORGE BUCHANAN,
Medical Department,
April 1st, 1890.

This inquiry was instituted in consequence of the Board having received information of an outbreak of diphtheria at Berkhamstead, affecting specially the Grammar School. It was supposed to be in some way related to defective sewerage.

Berkhamstead is a small town situated in the Berkhamstead rural sanitary district, under the jurisdiction of the Berkhamstead Rural Sanitary Authority. They have appointed a parochial committee to act for them in the town under the Public Health Act, 1875, section 202. The population is estimated at 5,500 persons. The town stands on the chalk formation. The principal street (High Street) running from N.W. to S.E. is about a mile in length, somewhat undulating, and intersected by several smaller streets. The Grand Junction Canal lies on the N. of the town, and between this and High Street flows the Bulbourne stream, running almost parallel to High Street but at a lower level, and entering the canal at the east end of the town.

King Edward's Grammar School stands in Castle Street, near the centre of the town, between High Street and the stream. The strength of the school is about 190 boys, of whom 98 are boarders, and the rest day scholars. The boarders reside in three separate houses, 64 living in the school-house in Castle Street with the head master, the Rev. T. C. Fry; and 19 and 15 respectively in two boarding-houses in High Street kept by assistant masters, Messrs. Fricker and Gowing. Of the 92 day boys, 58 reside in the town and 34 in the surrounding neighbourhood, coming in daily by train to attend school.

I commenced my inquiry at Berkhamstead on February 1st, when I placed myself in communication with Dr. Thompson, Medical Officer of Health, and the several medical practitioners of the town, who kindly supplied me with information respecting the several cases of throat illness that had come under their observation from September to December last inclusive. The teachers of the board and national schools likewise furnished me with the names of children who had absented themselves from school during the same period on account of sickness.

I did not hear of the presence of any throat illness in the town prior to September 18th. This was the date of the re-assembling of the Grammar School.

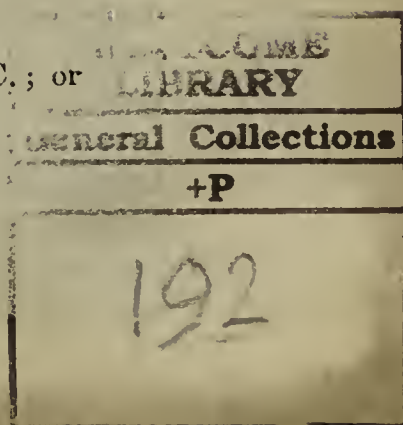
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Two cases have especial interest for the inquirer into the origin of the disease: one was the case of somebody, a boarder at the school, who first came under medical treatment for a sore throat during the last week of September; the other was a day scholar (H. T.) living at Kitsbury, a suburb of Berkhamstead, who stayed at home on September 24th on account of sore throat. The former case will come under consideration in the course of this report, but of the other case, as being earlier in point of his first definite symptoms, I proceed to give a more particular account.

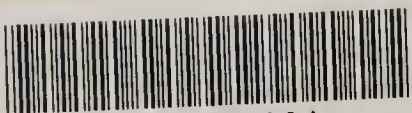
The Kitsbury family consisted of husband, wife, and five children, three boys (of whom H. T. was the second), two girls, and two servants. The ages of the children ranged between 9 and 14 years. The three boys all went to the Grammar School. H. T. was kept at home from September 24th to October 16th, when he returned to school for two days. In the meanwhile, early in October, his mother and one of his sisters were attacked with throat illness, followed on the 7th October by the eldest brother, who up to that date had continued to attend school. On October 9th, Mrs. T.'s illness was pronounced by her medical attendant to be diphtheria; subsequently the other sister was attacked, and lastly, on October 19th, the youngest boy, who up to that date had gone to school daily. This boy and his mother both suffered from diphtheritic paralysis. It should be noted that Mrs. T. had suffered from diphtheria some 20 years before, and all the family were subject to sore throats.

After this there was no further case of recognized diphtheria in the town until December 3rd; but it is in evidence that throat illness of more or less severity had continued present in the Grammar School, commencing shortly after the re-assembling of the boys. The attacks occurred in irregular sequence, viz., on September 24th (H. T., before-mentioned), 26th, 30th; October 2nd, 7th, 19th (the two last being H. T.'s brothers), 23rd, 26th; November 1st, 2nd, 4th, 11th, 13th, 18th, 22nd, 25th, 26th, and December 2nd. All the foregoing cases, with the exception of H. T. and his brothers, occurred in boarders living in one or other of the grammar school-houses. The cases were of an ill-defined character. The head master, indeed, expressed doubt as to whether certain ailments could properly be spoken of as "throat illness" at all.

After December 2nd the character of the disease changed, typical diphtheria of a virulent and fatal form manifesting itself, attacking first a day boy, G. A., on December 3rd, who died on December 13th. On December 5th, three cases of ill-defined throat illness occurred amongst the boarders. December 8th, a boarder was taken ill with what ultimately proved to be nasal diphtheria. [Unfortunately the nature of the attack was not recognised and the boy was sent to his home, with the sad result of his mother and two of his sisters contracting diphtheria and dying.] On December 9th, an assistant master lodging in the town was attacked. On the 11th, six boarders and one day scholar, one boarder dying. On the 13th, one boarder and one day scholar began to be ill. On the 14th the school was broken up, two boarders manifesting diphtheria after arrival at their homes, and one case proving fatal.

Altogether, inclusive of the recognised diphtheria cases, there was a total of 40 cases of throat illness, of which 30 occurred in boarders, four in day scholars, one in an assistant master lodging in the town, and the remaining five in the family of the day scholar, H. T. No case of diphtheria occurred in the town after the school was dispersed.

The children of the board and national schools were, according to the testimony of the teachers, exceptionally healthy during the term. The teachers did not remember any cases of sore throat amongst the children; but the lists of the National School showed some cases of mumps in a family, commencing on 20th September. Remembering my experience elsewhere of so-called mumps having been followed by marked diphtheritic paralysis, I made careful inquiry into the history of these cases, with the result of satisfying myself that there was nothing to justify suspicion that diphtheria had been present in these cases. So they may be dismissed from further consideration.—The doctors' lists show that two families, residing in the town, but unconnected with the Grammar School, were attacked with throat illness, one on November 14th the other on December 10th. In the first family the



mother was first attacked, followed by her two children, a circumstance suggesting that the woman's throat illness might have been contagious in character. But her symptoms were not such as usually belong to throat disease of any infective sort. She had great difficulty in swallowing till "something burst in her throat, which afforded instant relief," probably an abscess in the tonsil. The case of the 10th December occurred in a man who was the only one attacked out of a family of five or six persons, including two children. My inquiry into the particulars of the case went to confirm the opinion of the medical attendant as to the non-diphtheritic character of the illness.

It has been mentioned that the origin of the outbreak was attributed to nuisance caused by defective sewerage of the town. The assistant master and some of the boys who suffered from diphtheria made special complaint of the stinks emanating from the sewers in Castle Street.

The sewerage of the town, as will be presently shown, is of the most defective character, giving rise to nuisances that are everywhere prevalent to a greater or less degree. Yet I heard of only two families unconnected with the Grammar School who had come under medical treatment for throat illness, and this apparently not of a diphtheritic character. Again, persons passing through Castle Street on their way to and from the railway station or elsewhere, including those 35 day scholars who come in daily by train, are exposed to these sewage nuisances, and they all escaped. If sewer stinks in the specially offensive Castle Street were to be held responsible for the diphtheria in the assistant master and boys who complained of the stinks, diphtheria would have to be looked for equally amongst the residents of that locality, as well as amongst a notable number of persons frequenting the street. Yet I could hear of no such cases. On review of the whole case, it appears to me that stinks from the sewers must be excluded from having played any direct part in the dissemination of the disease. In like manner milk supply and domestic animals, channels by which diphtheria at other places has been found to be spread, can be dismissed. The water supply, too, may be absolved.

[The sanitary condition of H. T.'s home demands consideration, seeing that his throat illness was followed by five other cases in his family, including two typical cases of diphtheria. The drainage of this house is conveyed by a sewer to the Bulbourne stream to the west of the town, and is quite distinct from the town sewerage. The dwelling was at times rendered offensive, especially one small room in which Mrs. T. was in the habit of sitting with her boys when they prepared their lessons, by reason of a faulty closet, the contents of which went into a catchpit under the flooring of the closet; this had become broken, admitting the escape of sewer air into the house. The question arises whether the six cases of throat illness in this family were due to the unwholesome condition of the dwelling. Against this view I mention, for what it is worth, the escape of all throat illness amongst the occupants of other dwellings that drained into the same sewer.]

Reverting to the conditions of the Grammar School soon after its re-assembling on September 18th, I would say that it is not to be taken for granted, because H. T. was the first scholar to show a sore throat that the diphtheria originated with him. He was, it will be remembered, the earliest person in his household to be attacked, and it is quite possible that he was only the first of the school series, and got the complaint, like later cases, from some common infection of the school. And here we may see the interest of the other case, some boarder of whom I have previously spoken as coming first under medical treatment for a sore throat in the last week of September. One boarder made some complaint on the 26th, and it would hardly be safe to deny that that boy may have introduced the infection into the school. And a similar, and perhaps stronger, suspicion may attach to the case of another scholar, who first complained of his throat on the 30th instant; he was a boy (B.) who had been habitually subject to sore throats ever since he had had diphtheria, some five years before, so that it is not improbable that this boy's throat was bad some few days before he applied for medical treatment. Even if we should not accept the opinion advanced by some authorities that diphtheria poison may continue dormant in the system for an indefinite period after the first attack, we may yet believe that in B.'s

case his throat was in an infectious condition at an early (hardly noticeable) phase of his ailment. Looking at the whole evidence, as it presents itself to me, it seems to point very strongly to the school itself as being in some way concerned in the origin of the disease, the introduction being probably effected by some unrecognised case at the time of the re-assembling of the school.

The continuance of sore throat amongst the school boys, notably the boarders, could not be ascribed to any fault in the sanitary condition of the three school dwellings. Of the school-house itself, the general drainage arrangements were satisfactory. They had been carefully carried out, and included the cutting off of air communication with the sewer, the provision of efficient ventilation and flushing of drains and closets, and severing connexion of sink and bath pipes from drains. It is true that on examination of the main drain after the school had been dispersed, some joints were found to be defective, and had to be made good; but they were at a depth of some 4 or 5 feet from the surface, and cannot be supposed to have been concerned in the throat illness. The boarding-houses, on the contrary, were not so satisfactory. One house had a cess-pit privy on the premises, and the other had a closet which drained into a cess-pit, and the house drain in faulty connexion with the sewer.*

Whether the change in the type of the disease after December 2nd was dependent upon any peculiar atmospheric or other condition, or to any idiosyncrasy of constitution, there was nothing to show†; but after this, diphtheria spread rapidly amongst the boys, favoured no doubt by the same intermingling of infected and healthy in the school as had operated all along in keeping up the throat illness. The first sufferer from this more serious type of disease had attended choir practice on Sunday December 1st, and had there been brought into close contact with the assistant master and four or five boys, who were all subsequently attacked with diphtheria. Thus it appears to me that, just as the weight of evidence favours the conclusion that throat illness owed its introduction to some infected boy from home, so the dissemination was due to infected and healthy being brought together in the school. This conclusion is quite in keeping with experience elsewhere, it being no uncommon thing to find ill-defined throat illness obtaining in schools for a time, and ending in typical diphtheria; especially has this been found to be the case in the autumn, the season when these cases occurred. These facts should impress upon school authorities the importance of regarding any throat illness with suspicion, and the necessity of skilled observation, with the adoption of measures of isolation for cases that may have infective quality.

Sewerage and Drainage.—The sewerage and drainage of the town, as already said, is of a most defective character, involving faults in construction, and a method of disposal of sewage fraught with nuisance injurious to health. The main sewer which runs along High Street is merely an old brick sewer originally laid down by the highway authorities at a depth of about 2 feet for the conveyance of surface water, and is utterly unfitted for the purpose of carrying off sewage; it permits leakage, and it favours deposit. I had the sewer opened in two places, when I found some 4 inches of thick black mud at each place. This sewer receives the contents of various branch sewers from the streets on the south, and gives off sewers on the north which pass down certain streets, and ultimately discharge into the stream. The principal of these is the sewer which goes down Castle Street and empties into the stream on the east side of the bridge. Another sewer takes the sewage from the west end of the main

* These conditions have since been amended.

† As already stated, throat illness continued in the school till December 3rd, when G. A., one of the day scholars, was attacked with typical diphtheria. I made careful inquiry into the history of this case, and found that G. A. had played in a football match at King's Langley on November 30th (*i.e.*, three days before his attack), but so far as I could learn, by inquiry of the medical men practising in that neighbourhood and otherwise, there was no probability of exposure to the infection of diphtheria on that occasion. Thinking he might have incurred risk of such exposure by visiting the house of H. T., infected in October, I made inquiry in that direction, with the result of finding he had had no intercourse with them, as the T. family went to the sea-side during convalescence, and did not return home till after G. A.'s attack. Failing evidence of any other channel of infection to which G. A. was exposed, it would seem that the diphtheria in his case was intimately related to the previous and protracted throat illness in the school.

sewer, and ultimately enters the stream on the west side of the bridge. This sewer is actually provided with two catchpits for the subsidence of the solids; the larger catchpit being only a few feet removed from cottages, and giving rise to intolerable emanations, especially during the time of removal of the solid contents. I received loud complaints of the nuisance caused by the sewer outlets, which is said to be intensified by the admixture of hot brewery refuse.

The branch sewers are said to be constructed of glazed pipes. But no provision is made for the ventilation or flushing of the sewers.

From the foregoing it will be seen that the Berkhamstead Sanitary Authority have failed to fulfil the requirements of the Public Health Act, 1875, sections 15 and 19. That the evidence of this report goes to exculpate the sewerage evils existing in this town from direct concern in the causation and spread of throat illness on this occasion does not constitute the smallest justification for the present state of the sewerage. Not only is its condition a distinct violation of law, and a standing cause of offence and other danger to health, but its condition is such as to ensure the spread of such diseases as cholera and typhoid fever should they by chance be introduced into the town. Nor is mischief from the present condition of Berkhamstead sewers limited to the town itself, for the stream empties into the canal at the east end of the town, polluting its waters with foul and dangerous sewage. It, therefore behoves the Authority to adopt immediate remedial measures by the substitution of efficient sewerage and drainage, and to lose no time in obtaining the advice of a skilled engineer as to the means of gaining this efficiency.

In conclusion, I would express my sincere thanks to the head master, the Reverend T. C. Fry, the several medical practitioners, Messrs. Hobson, Batterbury, and Bontor, also to the teachers of the board and national schools, for their courteous and ready assistance in affording me information. My thanks are also greatly due to Dr. Thompson, the Medical Officer of Health, who accompanied me throughout my inquiry, and whose previous investigation had to a great extent cleared the way for me.

F. H. BLAXALL.

22nd February 1890.
